Remarks

Claims 1-7, 10-13, 16, 19 and 23-29 are presented for the Examiner's review and consideration. Claims 1-4, 6, 10-11, 13, 23, and 24-25 have been amended, and claims 21-22 have been cancelled. Applicant believes the claim amendments and remarks herein serve to clarify the present invention and are independent of patentability. No new matter has been added.

35 U.S.C. §101 Rejections

Claims 1-7, 10-13, 16, 19, and 21-27 were rejected under 35 U.S.C. §101 as being directed to non-statutory subject matter.

Specifically, the rejection stated that the claims are drawn to "a method for computing a point in a phase space" and "a method for computing a curve in a phase space," and as such the claimed invention does not fall within at least one of the four categories of patent eligible subject matter recited in 35 U.S.C. 101. The Examiner further stated that the claimed invention is directed to a judicial exception to 35 U.S.C. 101 (i.e., an abstract idea, natural phenomenon, or law of nature) and is not directed to a practical application of such judicial exception because the claims do not require any physical transformation and the invention as claimed does not produce a useful, concrete, and tangible result.

Initially, as noted above, claims 21-22 have been cancelled, rendering the rejection as to these claims moot.

Applicant has amended the claims to more particularly specify that the recited processing steps are each performed "with an electronic processor." With regards to the rejected machine implemented method claims, the Applicant asserts that the process of these claims includes a useful and tangible result that certainly has industrial applicability, namely, the providing as an output of the electronic processor a display of the point in phase space.

More specifically, the machine implemented method of, for example, claim 1 utilizes the stored information to calculate a single volatility of the sequence; scaling the volatility with a factor, the factor being dependent on the length of the sequence; calculating a net change in the data as a difference between data samples within the sequence; and determining a first and a second coordinate value of a point in phase space based on the volatility and net change. Claims 4, 10, 11, and 13 include similar elements.

The Applicant asserts that the practical data transformation performed by the present invention, as set forth by machine implemented method claims 1-7, 10-13, 16, 19, and 23-27, are comparable to the examples of the court precedent recited in the MPEP, namely:

> - Claims drawn to a long-distance telephone billing process containing mathematical algorithms were held to be directed to patentable subject matter because "the claimed process applies the Boolean principle to produce a useful, concrete, tangible result without pre-empting other uses of the mathematical principle." AT&T Corp. v. Excel Communications, Inc., 172 F.3d 1352, 1358, 50 USPQ2d 1447, 1452 (Fed. Cir. 1999);
>
> - "[T]ransformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces 'a useful, concrete and tangible result' -- a final share price momentarily fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades." State Street, 149 F.3d at 1373, 47 USPQ2d at 1601.
>
> MPEP § 2106(II)(A).

The Applicant asserts that the machine implemented method claims of the presently claimed invention are not solely the "manipulation of an abstract idea," but rather a practical process to produce tangible, useful results. The Applicant asserts that it is clear that the machine

implemented method of the present invention is a useful improvement over, for example, performing finite field multiplication by hand.

In light of the foregoing, the claims are directed to non-abstract ideas and include a tangible result. Applicant respectfully requests reconsideration and withdrawal of the 35 U.S.C. §101 rejections.

35 U.S.C. §112 Rejections

Claims 1-7, 10-13, 16, 19, and 21-27 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Specifically, the Examiner stated that claims 1, 21, 23, and 25 recite the limitation "calculating a difference between a first data sample and a last data sample of the first sequence." The Examiner further stated that it is not clear as to what "difference" is being calculated.

Initially, as noted above, claims 21-22 have been cancelled, rendering the rejection as to these claims moot. Claim 1 has been amended to more particularly point out and distinctly claim the subject matter pertaining to the rejection. Specifically, the element referenced in the rejection now recites, in claim 1:

> (d) calculating and storing with the electronic processor a net change in the data as a difference between data samples within the sequence, in accordance with the formula:
>
> $$R_{t,t+1}(p) = \ln(p_{t+1}) - \ln(p_t) \approx \frac{p_{t+1} - p_t}{p_t}$$, where t is a dimension and p is a data value;

Accordingly, Applicant respectfully submits that the scope of the claim with respect to "difference" would now be clear to one of ordinary skill in the art.

Claims 23 and 25 have analogous recitations. As such, Applicant submits that independent claims 1, 23 and 25 are in compliance with §112. As claims 2-7, 10-13, 16, 19 and 26-27 depend from claim 1, and claim 24 depends from claim 23, these dependent claims necessarily include all the elements of their base claims. Accordingly, Applicant respectfully submits that the dependent claims are in compliance with §112, as well.

In light of the foregoing, Applicant requests reconsideration and withdrawal of the §112 rejections.

35 U.S.C. §103 Rejections

Claims 1-7, 10-13, 16, 19, and 21-27 were rejected under 35 U.S.C. §103(a) as being unpatentable over Stewart (US Patent 6,195,103 B1) ("Stewart"), in view of Caccavale (US Patent 5,664,106) ("Caccavale"). In response, Applicant respectfully submits that this rejection should be withdrawn.

Initially, as noted above, claims 21-22 have been cancelled, rendering the rejection as to these claims moot.

In Stewart, the program computes 102 the relative changes or standardized returns from the time series data $X(t_i)$: $x(t_i)=[X(t_i)- X(t_{i-1})]/ X(t_{i-1})$. (Col. 6, lns. 56-58). ...the $x(t_i)$ will be referred to herein as the fluctuations. (Id). ...the volatility plot represents the fluctuations $x(t_i)$ of the time series $X(t_i)$ by assigning a color to each pixel or small square. (Id).

The color in each column I and each row j is determined from a comparison of a short pattern of the fluctuations $x(t_i)$ leading up to the first time t_i with a short pattern of the fluctuations leading up to the second time t_{i-1}. (Col. 7, lns. 4-8). For example, if the Euclidean distance is used, the program computes 104:

$$D(i,\ j,\ L) = \left\{ \sum_{l=1}^{L} [x(t_{i-1}) - x(t_{i-j-1})]^2 \right\}^{1/2}$$

The next step is to compute 106 from this distance a color for the pixel in column I, row j. (Col. 7, lns. 31-32). For example, if six distinct colors are used for the small squares, a scaling factor s may be chosen so that when multiplied by D most values of sD fall in the range 0 through 6. (Id).

Thus Stewart discloses display of the volatility of financial returns data as a series of colored areas. Stewart calculates volatility in accordance with the formula above, then scales the result so that the data will fit within a small numerical range corresponding to the available colors.

Thus, Stewart does not disclose logarithmic compensation of the data, either in calculating the return, or in calculating the volatility. Stewart further is limited to financial data, and more particularly to returns. In addition, there is no disclosure in Stewart of scaling the volatility with a factor dependent on the length of the sequence of data. In addition, Stewart does not visually represent returns and volatility at the same time.

Caccavale is directed to dynamically improving the performance of a server in a network... (Abstract). The first type of cache flushing, the "periodic" flushing, is considered to be a necessary part of any data cache mechanism. It counters the volatility of the data in cache buffers with the stability and permanence of storing the data in a permanent storage device. (Col. 16, ln. 65 - Col. 17, ln. 2).

Referring to FIG. 12, of Caccavale, there is shown a graph with RT_1, RT_2, and RT_3 as the x, y, and z axes, respectively. (Col. 27, lns. 60-61). Each sequential set of 3 response time values creates a triplet as shown in FIG. 13. (Id). Each triplet forms a single point on the graph. (Id). The maximum permissible response time forms a cube with the length of the sides being equal to RT_{sat}, as shown. (Id). It has been empirically determined that the set of triplets measured over time will typically be bounded by a sphere of radius r_b. (Id). The center of the sphere (which also defines the center of the cube) can be determined, for example, by computing the arithmetic mean of the triplet values calculated over a period of time. (Id). It is known that the rate at which the volume of a sphere is changing and the rate at which the radius of the sphere is changing are related. (Col. 28, lns. 61-63). The tuning system 1 estimates that the saturation point will be

reached at the time, t_{sat}, when the value of r_b changing at the rate of dr_b/dt will equal the value of RT_{sat} (in other words when the sphere reaches tangency with the cube). (Col. 29, lns. 7-11).

Caccavale thus discloses improving network server performance by utilizing an empirical observation that three particular related data types, when plotted, will be bound by a sphere, and observing the rate of expansion of such a sphere in estimating the saturation point of the server.

Caccavale thus does not disclose plotting volatility, as stated in the rejection. The only mention of volatility in Caccavale is as cited above, with respect to the volatility of data in cache buffers as compared to permanent storage; thus, volatility in Caccavale is unrelated to the present invention.

Applicant respectfully submits that one skilled in the art of presenting volatility of real world data would not look to Caccavale, which is not directed to volatility. Moreover, Applicant submits that no combination of Caccavale with Stewart can cure the deficiences of Stewart, as described above.

In contrast, the present invention relates to a method and computer system for computing and displaying a phase space, and more particularly, a method and computer system for the analysis and visualization of data, in particular with respect to financial data, such as stock market data. (Abstract).

Further, the invention is not restricted to the field of finance and economics, but is also applicable to all different kinds of data. For example the invention can be applied for the analysis and visualization of data samples from the fields of sociology, such as data from opinion polls, or even for comparison of the relative performance of football-teams. (¶[0051]). Furthermore, the invention is not restricted to data samples covering a specific period of time. Especially for data samples obtained from the fields of physical experiments and technology, the series of the data samples can also span other dimensions like length, energy or speed. (¶[0052]).

The invention is advantageous in that it enables valuation of the volatility versus the development of the observed variable over a specific period. (¶[0007]). In the case of financial data this enables relating the return to the volatility, such as for the comparison of the characteristics and performance of financial and stock market values. (Id). According to a

preferred embodiment the relation of the return and the volatility is displayed in a phase space. (¶[0008]).

Further the invention enables computation of a curve in the phase space. The points of the curve are calculated based on consecutive sub-sequences of the sequence of data samples. In the case of stock market data, a logarithmic grid is preferably used for determining the sub-sequences. (¶[0010]). This is of particular advantage for stock market data. For many stock values the volatility scales as the square root of time. (¶[0011]). This is compensated for by the logarithmic grid. (Id).

FIG. 3 of the invention shows an example of a display of the phase space with a corresponding sub-space. The phase space is defined by a coordinate system. The x-axis of the coordinate system is the scaled volatility and the y-axis is the return R. (¶[0073]). This way the relative performance and the differences in the quality of the stocks being considered become apparent. (¶[0075]).

An additional curve 3a delimits a further sub-space corresponding to a choice of a probability threshold... (¶[0078]). In essence the visualization in accordance with FIG. 3 enables intuitively comparing the relative performances and quality of a portfolio of stocks over an arbitrarily chosen time frame. (¶[0082]).

Thus the present invention enables an intuitive comparison of both volatility and return, for a variety of possible parameters, measured against a variety of possible dimensional values, where the result is adjusted so that the visualization is effective for different time periods. The calculations for volatility and return are different, and generate a more meaningful result than the prior art. Further, the form of visualization intuitively conveys more information than in the prior art.

Claim 1 recites, *inter alia*, a method for visualization of real world data by displaying a plurality of points in a phase space, the method comprising the steps of, for each point: (a) providing a sequence of data samples corresponding to the real world data measured in relation to a dimension; (b) calculating and storing with an electronic processor a single volatility of the sequence; (c) scaling and storing with the electronic processor the volatility with a factor, the factor being dependent on the length of the sequence; (d) calculating and storing with the

electronic processor a net change in the data as a difference between data samples within the sequence, in accordance with the formula: $R_{t,t+1}(p) = \ln(p_{t+1}) - \ln(p_t) \approx \frac{p_{t+1} - p_t}{p_t}$, where t is a dimension and p is a data value; (e) determining and storing with the electronic processor a first and a second coordinate value of a point in phase space based on the volatility and the net change; and (f) providing as an output of the electronic processor a display of the point in phase space.

Claims 23 and 25 have analogous recitations. Accordingly, Applicant respectfully submits that claims 1, 23, and 25 are patentable over Stewart in view of Caccavale. As claims 2-7, 10-13, 16, 19 and 26-27 depend from claim 1, and claim 24 depends from claim 23, these dependent claims necessarily include all the elements of their base claims. Accordingly, applicant respectfully submits that the dependent claims are allowable over the cited art for the same reasons.

In light of the foregoing, Applicant requests reconsideration and withdrawal of the §103 rejections.

New Claims

Applicant has added new claims 28 and 29. Applicant submits that the new claims are patentable over the cited art.

Conclusion

In light of the foregoing, this application is now in condition for allowance, or at least in better form for appeal, and early passage of this case to issue is respectfully requested. If any questions remain regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

No fee is believed due. However, please charge any additional fees (or credit any overpayments of fees) to the Deposit Account of the undersigned, Account No. 500601 (Docket No. 739-X01-005).

Respectfully submitted,

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